

MOLT MIGRATION OF LARGE CANADA GEESE ON THE WEST COAST OF HUDSON BAY

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Nonbreeding segments of some waterfowl populations migrate northward from their breeding grounds to undergo summer molt (Salomonsen 1968). Several authors have documented molting areas of the "large" races of Canada Geese (*Branta canadensis*) in the Northwest Territories (Kuyt 1962, 1966; Hanson 1965; Sterling and Dzubin 1967). Although the relationship of the molting to the breeding ranges of the populations involved has been discussed, there is little information on the actual migration. Here we present data on the northward molt migration of large Canada geese along the west coast of Hudson Bay at the mouth of the McConnell River, with some comparative data from the Churchill area of Manitoba, and discuss the origin and destination of the birds involved. The races involved are *B. c. interior* and *moffitti*, sensu Palmer (1976), who included *maxima* in *moffitti*. Although the name "*maxima*" is commonly used in the literature, we follow Palmer as the most recently published authority.

METHODS

We observed molt migration of large geese during extensive studies of "small" Canada Geese (*B. c. hutchinsii-parvipes* complex, MacInnes 1966) nesting at the mouth of the McConnell River (60°50'N, 94°25'W; MacInnes et al. 1974). Migrating large geese were easily distinguished from residents by their larger size, distinctive voice, and slower wing beat.

Observations on nesting small Canadas took place daily during May through August. Casual observations of the molt migration of large geese were made during these months in 1959-60 and 1964-68, including recording the first and last dates and peak periods of migration. Systematic observations in 1969 and, to a lesser extent, 1970, allowed estimates of total numbers to be made. Additional observations were made by C. D. Ankney in 1971, and by Pakulak from 1967 to 1970 in the Churchill area (58°45'N, 94°5'W) about 250 km south of the McConnell River.

In 1969, the senior author was engaged in intensive study of loons, primarily from an elevated live-in blind, and was able to make nearly continuous observations of migrating large geese over a strip of Hudson Bay coast about 8 km wide. Loud, distinctive calls of flocks passing over drew attention to them, and normally the observer was able to make a count. During periods when actual counts were not taken, estimates were made based on daily impressions of overall volume, incidental counts by three other observers, and the volume in preceding and following counts. Estimates of total numbers were compiled for

^a Allan Pakulak died in a helicopter crash in 1972. He contributed actively to this paper before that event.

TABLE 1
 CHRONOLOGY OF MOLT MIGRATION OF LARGE CANADA GEESE AT THE MCCONNELL RIVER,
 NORTHWEST TERRITORIES, CANADA

Year	First flocks	Period of peak migration	Last northbound flocks
1959	23 June	23–26 June	3 July
1960	19 June	22–28 June	5 July
1964	18 June	23–25 June	8 July
1965	18 June	22–27 June	27 June
1966	18 June	26–29 June	2 July
1967	19 June	29 June–2 July	22 July
1968	16 June	25–28 June	28 June
1969	17 June	21–26 June	27 July
1970	12 June	25–30 June	11 July
1971	9 June	16–26 June	13 July

07:00–24:00 of each day in the migration period (17 June–27 July) (Table 1). Actual counts were most frequent on the days of heaviest passage, and were well spread over the day. Pakulak's counts at Cape Churchill were made in a similar manner, also during extensive daily field work, but he covered only a 4-km wide area, and made no estimates beyond his actual counts.

Directions taken by flying birds were noted in 1969, and flight elevation was estimated for a sample of 3077 geese during 21–24 June. Three categories were recognized: low (<30 m), medium (30–150 m), and high (> 150 m).

RESULTS

Chronology. —In nine years of observation, first migrants were always seen within a 10-day period in mid-June, and peak numbers almost always occurred in the last 10 days of June (Table 1). Data for 1959 may not be accurate, as large geese were not expected, and early flocks could have been overlooked. Data from Zicus (1981) also showed that flocks leave a nesting area to molt about the same time each year, regardless of timing of the breeding season.

Numbers. —In 1969, birds passed over in flocks of 4–110 at all times of day. In late June and early July, the sun was below the horizon for 3–4 h, but there was some light at all times. We have no feeling, however, for what proportion of passage occurred at night. Flocks early in the season were often accompanied by Lesser Snow Geese (*Chen c. caerulescens*) and Tundra Swans (*Olor columbianus*).

A total of 10,292 birds was actually counted at the McConnell Delta in 1969 (Table 2), and we estimate 17,500 flew northward over the area between 07:00 and 24:00 during the entire migration period (17 June–27 July) (Fig. 1). Only 5000 birds were estimated in 1970. Despite less in-

TABLE 2

ACTUAL AND ESTIMATED NUMBERS OF LARGE CANADA GEESE PASSING THE MCCONNELL RIVER DELTA IN 1969

Date	Actual count	Additional estimated*	Total
17 June	28	0	28
18-19 June	0	0	0
20 June	24	0	24
21 June	5289	1724	7013
22 June	929	1700	2629
23 June	136	300	436
24 June	2176	950	3126
25 June	110	250	360
26 June	810	650	1460
27 June	245	400	645
28 June	176	350	526
29 June	90	400	490
30 June	0	0	0
1 July	2	0	2
2 July	72	200	272
3 July	0	0	0
4 July	99	150	249
5 July	— ^b	—	—
6 July	44	0	44
7 July	26	0	26
8-17 July	0	0	0
18 July	23	0	23
19-26 July	0	0	0
27 July	13	0	13
Totals	10,292	7074	17,366

* See Methods.

^b No observations on this day.

tensive observations in that year, we are confident that total numbers were in fact markedly lower than in 1969. Pakulak counted 13,462 passing over Cape Churchill in 1969, but he counted only 6587 there in 1970.

Pakulak made no local counts at Churchill in the period 14-21 June 1969, as he was then engaged in extensive helicopter surveys over a wider area. The number of migrating large Canadas seen in the wider area in that entire period came to only 2945, confirming a considerably later molt migration at Cape Churchill than at the McConnell Delta (Fig. 1).

Routes. — Birds heading NNE past the McConnell Delta (Fig. 2) were following the coastline. Many geese changed direction upon reaching the McConnell, turning away from the coastline to fly up the river (Table 3, Fig. 2). The use of landmarks by waterfowl on migration routes is common

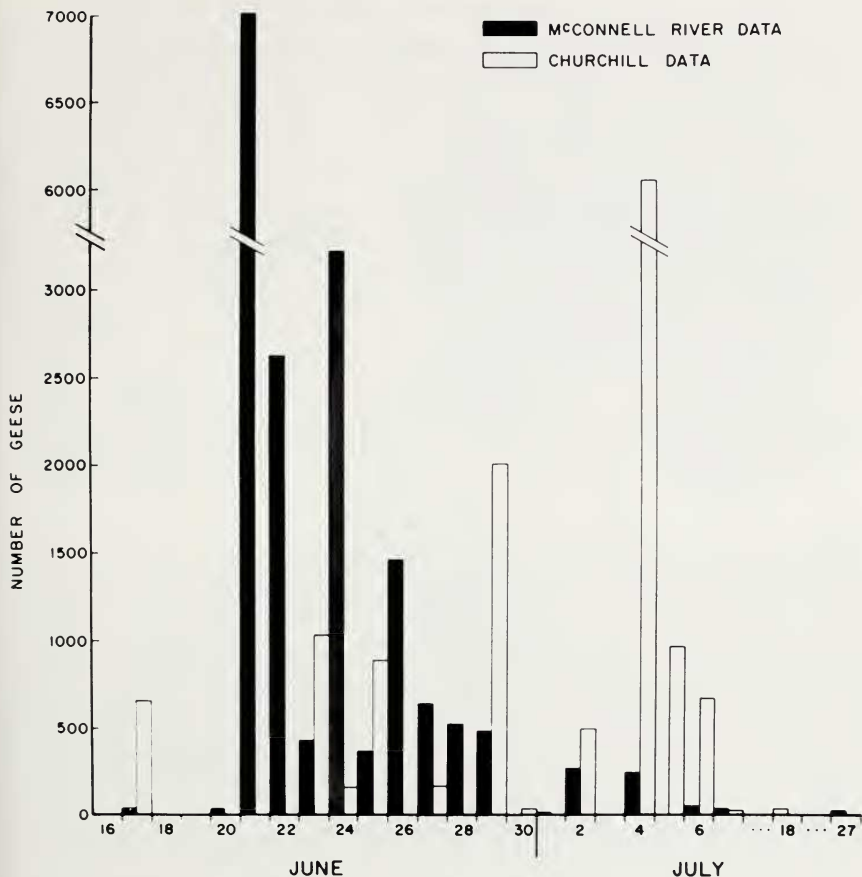


FIG. 1. Estimated daily numbers of large Canada geese flying north past the McConnell River (dark bars) and actual counts from Churchill (light bars) in 1969.

(Hochbaum 1955). Other birds heading inland at the McConnell Delta may not have changed direction, as a back-bearing for these birds is a direct line from York Factory, following the line of the coast from there to Cape Churchill. The proportions of flocks going NNE and N, NNW, or WNW were different between 1970 and each of the other 2 years ($\chi^2 = 68.8$ and 65.3 , $df = 2$, $P < 0.005$), but not between 1969 and 1971 ($\chi^2 = 2.6$, $df = 2$, $P < 0.25$). In 1970, over 90% of the birds followed the coast NNE, while only 40% did so in the other 2 years (Table 3).

The height of migrating flocks was related to direction (Table 4), with those flocks flying highest (> 150 m) tending to maintain a NNE course

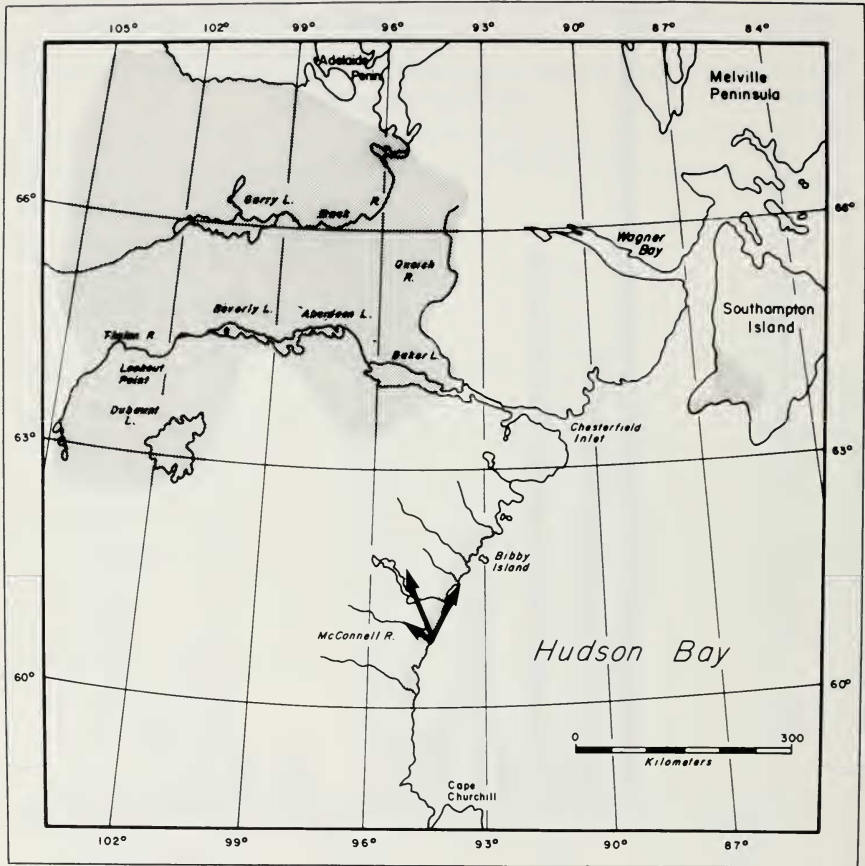


FIG. 2. Position of the McConnell River with respect to known molting areas of large Canada geese (shaded). Arrows indicate main directions of molt migration past the river delta. Lengths of arrows are proportional to the numbers of geese heading in those directions in 1969 and 1971.

($\chi^2 = 35.6$, $df = 2$, $P < 0.005$). There was no relation between flying height and time of day of passage.

The NNW bearing from McConnell is close to being on a direct line from Cape Churchill (Fig. 2). The clear difference in timing of molt migration at the two sites (Fig. 1) indicates, however, that the birds seen at each location were not the same. Circumstantial evidence that the Churchill birds flew more directly over Hudson Bay comes from observations on 25 June 1970. A total of 5820 birds was counted leaving the Cape, but only 245 were seen at the McConnell. Ian Newton (pers. comm.),

TABLE 3
DIRECTION OF LARGE CANADA GEESE LEAVING THE MCCONNELL RIVER, NORTHWEST TERRITORIES

Flight direction*	Number of birds/number of flocks		
	1969	1970	1971
NNE	2679 (33) ^b /75 (31)	1480 (91) ^c /60 (92)	2003 (38) ^c /46 (33)
N	598 (7)/8 (3)		
NNW	3609 (45)/111 (46)	100 (6)/2 (3)	2475 (48)/76 (55)
WNW	894 (11)/35 (15)	15 (1)/1 (2)	663 (13)/14 (10)
Landed at			
McConnell	334 (4)/11 (5)	36 (2)/2 (3)	71 (1)/2 (1)
Totals	8114/240	1631/65	5212/138

* Birds flying NNE were flying along the coast, those flying WNW were headed upriver.

^b Percent of column total.

^c Combined total for NNE and N.

however, saw 591 that morning while at sea 7–12 km from shore, between the McConnell Delta and Eskimo Point (30–35 km to the north).

Origin of migrants.—Thirty-three molting large Canada geese were trapped at the McConnell River between 1960 and 1967 in banding drives of local small geese. Seven of these had been banded elsewhere. In addition, nine birds with neck bands were observed among migrating flocks. The birds with neck bands had been marked on wintering areas at Swan Lake National Wildlife Refuge in Missouri, and released there or at refuges in Arkansas and Louisiana (all in area B, Fig. 3). The birds trapped at the McConnell apparently were from the same population, as five either

TABLE 4
RELATION BETWEEN APPROXIMATE HEIGHT OF MIGRATION AND DIRECTION OF LARGE CANADA GEESE PASSING THE MCCONNELL RIVER, NORTHWEST TERRITORIES, 21–24 JUNE 1969

Flight direction*	Numbers of birds and flocks at heights of:		
	>150 m	30–150 m	<30 m
NNE	489 (68) ^b /11 (73)	133 (22)/7 (37)	333 (19)/8 (14)
N	232 (32)/4 (27)	0 (0)/0 (0)	77 (4)/1 (2)
NNW	0 (0)/0 (0)	416 (68)/10 (53)	992 (57)/33 (58)
WNW	0 (0)/0 (0)	61 (10)/2 (11)	344 (20)/15 (26)
Totals	721/15	610/19	1746/57

* Birds flying NNE were flying along the coast; those flying WNW were headed upriver.

^b Percent of column total.

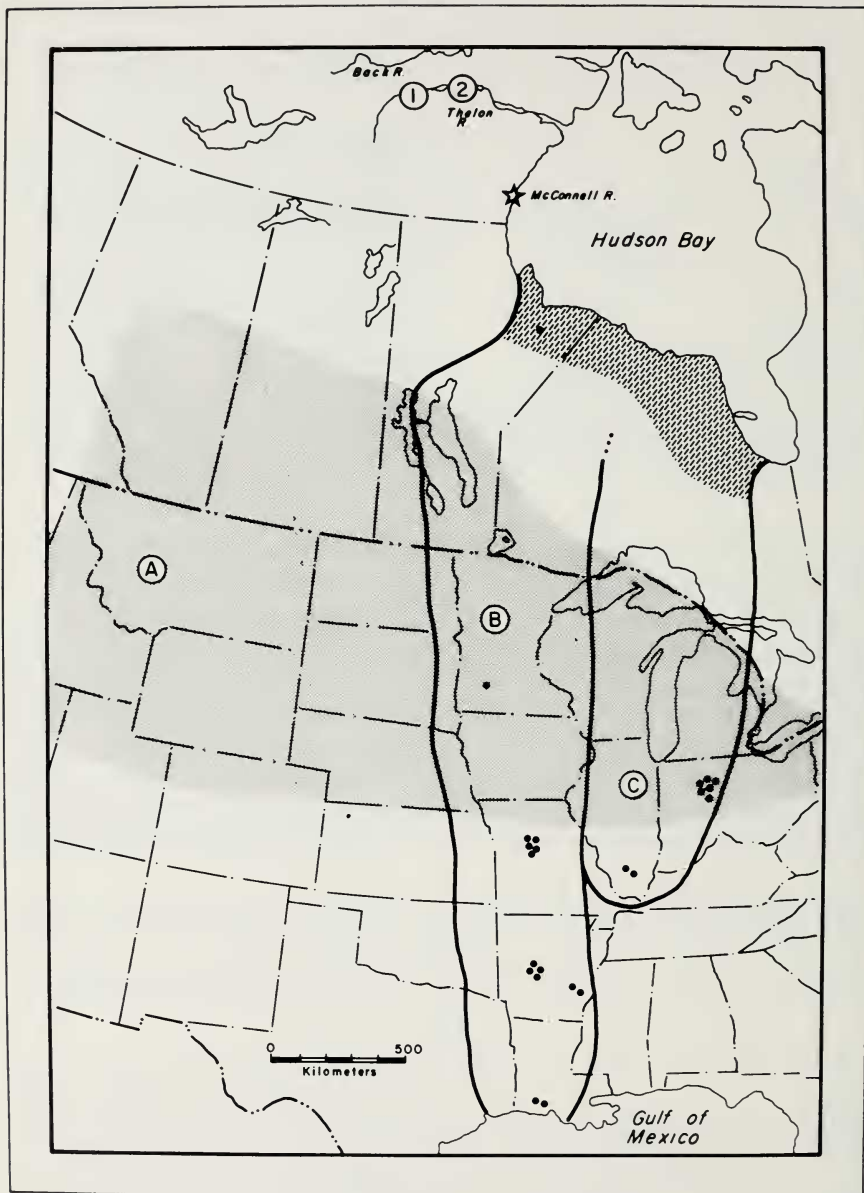


FIG. 3. Banding or recovery locations of large Canada geese seen at the McConnell river (dots). The large shaded area is the approximate breeding range of *B. c. moffitti* (including "maxima"), with A indicating the western part of the range. Outlined areas represent breeding (hatched) and wintering areas of *B. c. interior* in the Eastern Prairie Population

came from, or were subsequently retrapped at, those same refuges. Two birds banded at McConnell River, however, wintered in southern Illinois, one bird shot 60 km north of the McConnell River was also from Illinois, and six birds recaptured at McConnell were banded in Mercer County, Ohio (all in area C, Fig. 3). This suggests that at least three populations were involved in the McConnell River molt migration. The Ohio birds were from a known breeding population of *B. c. moffitti* (= *maxima*, Bednarik 1970). Most banded birds came from the wintering area of the Eastern Prairie Population (EPP; Vaught and Kirsch 1966) (area B, Fig. 3), with smaller numbers from the Mississippi Valley Population (MVP) (area C, Fig. 3). Two molt migrants collected at McConnell were *B. c. interior* (identified by W. E. Godfrey, National Museum of Canada, and by CDM). This is the predominant race of both the EPP and MVP wintering areas (Bellrose 1976).

DISCUSSION

Our observations suggest that at least two separate streams of large Canada geese pass by the McConnell River on northward molt migration. The first of these basically is following the Hudson Bay coast to the NNE or heading within 20°W of that.

The second major stream turns at the McConnell River and heads inland from the Hudson Bay coast on bearings well W of N, sometimes flying upriver to the NNW (Fig. 2). The first 30 km of the McConnell River has a bearing of 320°, and a direct line following that heading leads to the upper Thelon River–Lookout Point portion of a known molting area (Sterling and Dzubin 1967) (Fig. 2). A direct bearing from the McConnell to the Thelon Islands is 325–335°, close to the NNW heading of the largest number of geese we counted. Birds on these bearings fly close to the ground (Table 4).

The lack of synchrony between birds leaving Cape Churchill and those passing the McConnell River suggests that the Churchill birds constitute a third stream, perhaps passing to the east of the McConnell Delta, but we could not confirm this. The combined estimated total from narrow strips of coast at Churchill and the McConnell Delta in 1969 was 30,500, similar to the entire 30,000 estimated to be molting in the area surveyed by Sterling and Dzubin (1967). Even after we take into account any errors

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(B) and the Mississippi Valley Population (C). Numbers show sites on the Thelon River molting range where Canada geese have been trapped and banded: 1 = Lookout Point, 2 = Beverly and Aberdeen lakes (see Fig. 2).

in estimation or overlap in counts, it appears that a large fraction of west coast Hudson Bay molt migrants pass over these two points.

The geese heading NW from the McConnell appear to be heading to the central portion of the known molting area (Fig. 2), and there is circumstantial evidence in support of this being their destination. Very few molting Canadas were seen on the Thelon River in 1970 (W. Speller, pers. comm.), the same year that very few headed inland from the McConnell (Table 3). A great many molt migrants were on the Thelon in 1968 and 1969.

Kuyt (1966) and Sterling and Dzubin (1967) showed that birds molting at points 1 and 2 came mainly from areas A and B, respectively (Fig. 3). Banding data from the McConnell show that our birds are more eastern in origin and, accordingly, some may be heading farther east than the central Thelon to molt. Those birds following the coast at the McConnell could be going to currently undiscovered molting areas. Some geese still follow the coast at Eskimo Point, 35 km north of the McConnell (Pengally, pers. comm.), and small numbers have been found resting on Bibby Island, 140 km to the north (Fig. 2).

An extensive helicopter survey in 1969 of the goose habitat within 25 km of Hudson Bay between 60°N and 62°N revealed no flock of large Canada geese > 110, but there were several small, widely scattered groups. Large geese following the coast north from the McConnell River may spread thinly over a wide area, making them almost impossible to count by aerial survey.

The notable regularity of molt migration timing (Zicus 1981) (Table 1), despite wide variation in the start of breeding seasons and different origins of migrants, suggests that the migration is timed to take advantage of the molting areas as soon as they become available in spring (Sterling and Dzubin 1967). On average, this would occur in late June.

The migrants themselves are primarily young birds (one to three years old, Sterling and Dzubin 1967), but unsuccessful breeding adults may also join. Changes in volume of migration may come about in two ways: when unusual reproductive success in one or two immediately preceding seasons alters the number of subadult geese, or when conditions in the current season alter the proportion of adults which do not nest successfully.

SUMMARY

Over 30,000 large Canada geese (*Branta canadensis*) pass Cape Churchill and the McConnell River delta on northward molt migration. Birds passing the McConnell are *B. c. moffitti* (sensu Palmer 1976) and *interior*, mainly from the Eastern Prairie Population, with somewhat fewer from the Mississippi Valley Population. Geese following the coastline generally fly

above 150 m, while those heading inland fly at lower altitudes. The two streams are probably going to the central Thelon River and more to the east. Birds passing Churchill migrate later and apparently pass the McConnell Delta offshore.

The time of molt migration is regular—with peak numbers in late June—but variable in volume. Breeding success the previous year probably affects numbers markedly, as most birds on molt migration are immatures.

ACKNOWLEDGMENTS

The studies of which this is a part were funded by the Arctic Institute of North America, the Canadian National Sportsmen's Show, the Canadian Wildlife Service, the National Research Council of Canada (Grants A-1980 and A-3919), and the Wildlife Management Institute. Thanks to C. D. Ankney, University of Western Ontario, for 1971 data, and to E. Dunn, whose work on the later versions of this paper is greatly appreciated. This is Ontario Ministry of Natural Resources Wildlife Research Section Contribution No. 84-08.

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